WEST AFRICAN COCOA RESEARCH INSTITUTE

QUARTERLY PROGRESS REPORT

No. 59

TAFO, GHANA.

PRINTED BY THE HAG PRESS—PRINTERS, TAFO.

22 FEB 1961

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FIFTY-NINTH QUARTERLY REPORT

JULY-SEPTEMBER, 1960

Any results recorded in this report should not be accepted as conclusive inasmuch as the report contains interim information only. More complete results are published in W.A.C.R.I. Technical Bulletins and elsewhere.

SENIOR STAFF

Director	J. Lamb (returned from leave 18/8/60)
Secretary	A.F. Neale
Accountant	J.N.A. Hyde
Office Asst./Librarian	Mrs. D.J. Adams (Miss D.J. Ellis (on leave)
TAFO STATION	
Division of Entomology	E. Dunn (returned from leave 27/7/60)
	K.B. Armstrong (returned from leave 4/8/60)
	M.R. Smith
	V. Ammah-Attoh (joined 16/8/60)
Division of Pathology	J.W. Blencowe (Ag. Director to 11/8/60, on leave 12/8/60)
	A.L. Wharton (returned from leave 16/8/60)
	P.D. Turner (returned from leave 10/8/60)
	A.A.F. Brunt
	A. Attafuah (on scholarship in U.K.)
Division of Botany	D.R. Glendinning (on leave)
	R.G. Lockard
	E.J.A. Asomaning (joined 26/9/60)
Division of Chemistry	R.H. Kenten (Ag. Director 12/7/60 -10/8/60)
	D.K. Acquaye (joined 7/9/60)
Division of Agronomy	T.H.R. Hall
	R.W. Smith
Statistician	C. de Jonge
Laboratory Technicians: (Electronics)	A.J.H. Arnold
(Spectrography)	J.C. Burridge
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Deputy Director (Nigeria)	T.W. Tinsley
Secretary	H.L. Pugh (on leave 19/7/60)
Entomologists	R.G. Donald
	P.F. Entwistle
	C.K.H. Martini
Pathologist	D.Kay (on leave prior to termination 12/7/60)
Agronomists	J. Longworth
	G.H. Freeman (joined 14/9/60)
Mycologist	E.C. Hislop
Plantations Officer	W. Rides
WEST AFRICAN FUNGICIDES RESEARCH UNIT	
Chemist	P.O. Park.

STAFF MATTERS

Mr. J. Lamb returned from leave on 18th August 1960.

Mr. E. Dunn returned from leave in July, and Messrs. K.B. Armstrong, P.D. Turner and A.L. Wharton in August.

Three new members of staff joined the Institute from scholarship courses in the United Kingdom, Mr. V. Ammah-Attoh in August and Drs. D.K. Acguaye and E.J.A. Asomaning in September.

Dr. G.H. Freeman joined the staff at Ibadan in September.

Dr. W. Carter, of the Pineapple Research Institute, Hawaii, arrived at Tafo on 30th September for a five-month period of attachment to the Institute as a Consultant.

Dr. T.W. Tinsley, Deputy Director, returned from conferences overseas on 19th July.

VISITORS

Visitors to Tafo included a delegation from the Vietnamic Department of Agriculture, The Chief Cocoa Officer, Ghana, Mr. E. Scarlett from the Colonial Office, Sir Robert Aitken of the Overseas Research Council, London, the Indian High Commissioner to Ghana and Nigeria, the President of the Cocoa Chocolate and Confectionery Alliance and representatives of commercial concerns interested in cocoa.

Visitors to Ibadan included Sir Robert Aitken, Chairman of the Overseas Research Council, Mr. W. Stint, Agricultural Officer, New Guinea, and representatives of overseas cocoa buying and manufacturing firms.

GAMBARI EXPERIMENTAL STATION

The notice of acquisition by the Ministry of Agriculture and Natural Resources, Western Regional Government, of the areas required for leasing to W.A.C.R.I. appeared in the Gazette of 1st September.

Very heavy rains at the end of June and during the first half of the quarter caused flooding of the Ona River and have prevented the construction of a new bridge on the main Ibadan - Ijebu Ode road just north of the station which was cut off from Ibadan for almost half of July. The rains have also delayed work on surveying of building sites and the opening up of new roads. A rough road has been cut across the southern part of the area, through the site for staff quarters and labour lines to the river on the boundary, near which a site of approximately 1½ acres has been cleared for a nursery.

Economically valuable trees along the road and at the nurser site have been makred by members of the Forestry Division who have

arranged for a contractor to extract the timber.

One prefabricated store and two field shelters have been erected, but a further store for cement and toqlsawaits drier road conditions before it can be built at the nursery site.

AGRONOMY DIVISION

OLD STATION FARM

The yield from the twenty-two ¼-acre plots is shown in Table A1.

Table A1 : Pods from twenty-two ¼-acre plots - Station Farm

Plots	Harvested	Diseased	Total
Tree recorded (5)	4,233	650	4,883
Plot recorded (17)	16,153	1,372	17,525
Total (22)	20,386	2,022	22,408

TREE MORTALITY

Table A2 : Tree Mortality

Month 1960	Trees destroyed		Total	Seedlings removed	Grand Total
	Swollen Shoot	Undiagnosed			
July	50	5	55	23	78
August	21	2	23	31	54
September	24	5	29	22	51
TOTAL	95	12	107	76	183

SQUARE MILE

Maintenance of Mature Cocoa

Routine harvesting of all experiments was carried out. The yields from these experimental areas are shown in Table A3. During the quarter this division took over the harvesting of the early bearing trial (P1) from the Bot any Division. The second application

Table A3: Yields from the Experimental plots - Square Mile.

No.	Experiment	Plot	September Quarter 1960	June Quarter 1960
1	U.A. Spacing & Pruning	B2	19,543	23,205
2	U.A. " Extension	B2(a)	5,566	5,942
3	U.A. Multiplication	B1	28,159	21,708
4	Amelonado Spacing Trial	J1	49,490	42,691
5	Factorial Fertilizer Trial	G5	10,400	15,945
6	2nd Establishment Trial	H1 &L2	25,000	12,239
7	Uniformity Trial	G1	71,752	39,598
8	Amelonado Pruning Trial	P2	4,702	1,742
9	" Source Trial	G4	4,891	3,381
10	Shade and Manurial Trial	K1	56,937	23,604
11	Amazon Tree Forming	D7	1,281	981
12	Pathology Expt. Plot	A4	601	1,884
13	" " "	A6	5,806	7,060
14	" " "	H2	1,054	1,795
15	" " "	H3	1,624	3,154
16	Early Bearing Experiment	P1	5,329	-
	T o t a l	-	292,135	204,929

of Urea commenced in September, and by the end of the quarter two areas remained to be fertilized. Because of the 1960/61 main crop maturing early, the labour requirements for fertilizer application over lapped those for harvesting, the schedules of which could not be delayed and consequently the application of fertilizer has to be fitted in when convenient.

In the Amelonado Spacing Trial 10 trees had to be removed because of an outbreak of swollen shoot. Four trees have been killed by a root rot fungus.

MAINTENANCE OF YOUNG COCOA

Shade Experiment

The weed growth in the banana plots is significantly less than in the plots where plantains, tree cassava and a mixture of the cassava and plantain shade occur. The trash from banana thinnings not only acts as a mulch but keeps the weed growth in check. Weeding in all plots, other than where banana has been used for shade, has been continuous. Weed control under banana shade has not been necessary. No appreciable differences under the four shade regimes were recorded for the height of jorquette and time

taken to form the jorquette. A few flowers have formed, some of which have set cherelles in the plots with cassava shade.

VIRUS RESISTANCE TRIAL

Regular weeding, and shade reduction of tree cassava have been carried out. The first pod was collected from the cross T86/956 x T86/1600.

NEW PLANTINGS

Routine maintenance of the Seed Garden was carried out and growth has been extremely satisfactory. A few trees died and were replaced . In the plot where a study is being made of the management of clonal material, control of the shade canopy has been carried out. In the Black Pod Resistance Trial at Mpraeso, weed control around the Tree Cassava, and replacement of dead Terminalia ivorensis was carried out.

CLONAL NURSERY

Regeneration from the coppiced clones had been sufficient to allow for the taking of cuttings. During the quarter, the numbers of cuttings becoming available, weekly and monthly were recorded. Stools which failed to regenerate, have been replaced.

HYBRID SHADE AND MANURIAL TRIAL

A Hybrid Shade and Manurial Trial has been laid down to investigate shade and fertilizer as limiting factors in the growth of new Hybrids. The trial takes the form of a randomized block design, blocks being confounded with year of planting owing to shortage of planting material. Each block consists of 4 main plots- one for each variety - and each plot is divided into 4 sub-plots for shade and fertilizer treatments.

One block of this trial was planted during the second and third weeks of July. Unfortunately an unseasonal dry spell interrupted the planting, and the seedlings had to be watered. A fertilizer dressing was applied at planting time.

THINNING TRIAL

This trial has been laid down to ascertain the best method of thinning closely spaced cocoa planted at half the final spacing. It is intended to obtain the benefits of close spacing at establishment and during the first years of bearing, and then obtain the optimum final spacing

The four treatments are (a) control initially planted at 10' x 10' (b) Thinning from 5' x 5' to 10' x 10', irregularly depending upon the canopy condition. (c) Regular thinning to 10' x 10' over two years, (d) Restricting the trees to be removed

during thinning to the first jorquette, whilst allowing those to remain finally to grow unchecked.

The trial was planted at the end of July, and establishment has been satisfactory.

PROPAGATION

A total of 859 cuttings were set during the quarter of which 808 were successfully hardened. 120 stocks were budded with Lafi No.7 for the Black Pod Trial at Obomeng (Mpraeso).

A start was made on reconditioning the propagator.

ORNAMENTAL NURSERY

Various ornamentals were supplied for the residential area, while perennials were raised for the laboratory area.

METEOROLOGY

Rainfall figures are shown in Table A4. The very dry July which made planting difficult should be noted.

Table A4 : Meteorology

Month	1960		Past 22-year means	
	Rainfall (ins)	Wet Days	Rainfall (ins)	Wet Days
July	1.89	11	5.75	14.0
August	4.53	14	2.42	12.5
Sept.	9.75	21	5.92	14.5
Total	16.17	46	14.09	41.0

PATHOLOGY DIVISION

VIRUS RESEARCH

MECHANICAL TRANSMISSION OF COCOA SWOLLEN SHOOT AND MOTTLE LEAF VIRUSES

Work has continued along the lines described in the previous Quarterly Report. Very low rates of transmission of swollen shoot virus from Bombax brevicuspe Sprague to Adansonia digitata L. and cocoa mottle leaf virus from Hildegardia barteri (Mast.) Kosterm. to cocoa half-beans have been obtained.

BLACK-POD DISEASE

MECHANISMS OF RESISTANCE TO PHYTOPHTHORA PALMIVORA BUTL.

Records of the incidence of P. palmivora pod infections

on all the selections in the 1st and 2nd Clonal Trials have shown a number of selections to possess either a high susceptibility or a greater or lesser degree of the so-called 'field resistance' to the disease. The basis of this resistance has not been determined, and a research programme has been prepared to elucidate the factor or factors underlying the resistance. It is unlikely that a single factor will be found to confer resistance; more likely resistance will be found to be the result of all the factors which tend to reduce the aggressiveness or pathogenic activities of the parasite after contact with the pod has been made. Knowledge of these factors would be of considerable value in breeding and selection of cocoa types resistant or tolerant to the disease, and should provide an accurate laboratory method for testing selections, thus shortening certain aspects of the trial period by a number of years and automatically eliminating certain selections as unsuitable. The proposed programme covers all aspects of the disease, from the time that the first infective spore comes into contact with a pod to the time when the pod itself is behaving as a secondary source of inoculum. Despite the amount of research which has been carried out on black-pod disease, little information is available on the actual parasitism of the pod by the fungus, knowledge which is essential if the nature of the disease and of resistance to it are to be understood. Tests will be of a comparative nature as, in practice, resistance is nearly always relative and must be measured against a standard of susceptibility.

A GALL DISEASE OF COCOA IN GHANA

The infective isolate C. rigidiuscula considered to be in pure culture (Quarterly Report 58) has been re-isolated from discrete colonies on plates of nutrient agar without any evidence of contamination. These re-isolates are infective, producing galls on all cocoa seedlings inoculated as beans. Two further isolates of C. rigidiuscula (B151 and B157) have been collected from seedling galls by streaking gall diffusates onto nutrient agar and culturing from discrete colonies of the fungus. Both these cultures are also highly infective, and have remained equally so after treatment with Aureomycin (30 µgm. per ml.), an antibiotic with a wide range of inhibition against bacteria.

Galls similar to, but much smaller than, cocoa seedling galls have developed in the cotyledonary axiles of 7 of 11 Vigna sinensis seedlings which were inoculated at the bean stage with an infective culture of C. rigidiuscula Cocoa half-beans have been inoculated with extracts from Vigna galls to determine if galls on cocoa and V. sinensis have the same cause.

ENTOMOLOGY DIVISION

LEAF EATING LEPIDOPTERA

Routine collecting and rearing of lepidopterous larvae found on cocoa is continuing.

NURSE SHADE V. NO SHADE EXPERIMENT

Fortnightly applications of insecticides are now being made. One third (12) of the plots are being treated with Sevin 85 (0.625% active ingredient) and another third with Dipterex 80 S.P. (1% active ingredient); both insecticides being applied with 'Leo-Colibri' Pneumatic knapsack sprayers at the rate of approximately 12 gallons per acre. The remaining 12 plots are being left as untreated controls.

There are indications that some varieties of cocoa are able to withstand Earias attack better than others and this appears to be due to differences in general vegetative vigour. It is possible that fertilizer application will increase the vigour of weaker varieties and enable them to withstand Earias attack. A mixture of urea and superphosphate has therefore been applied, at the rate of 4 oz. per tree, to half of every plot.

CAPSID STUDIES

LABORATORY ASSESSMENT OF INSECTICIDES

Work has continued on the laboratory screening of potential capsicides using dry deposits applied by means of a Potter Tower. Comparison with gamma-BHC is made at L.D.50 and L.D.90 values. Fifteen insecticidal formulations have now been investigated.

MEALYBUG STUDIES

OYOKO

Although ant and mealybug counts have been terminated on these plots monthly records of trees cut out are still being made. For the present quarter the treated area which included removal of contact trees (treatment D) has had the least number of trees removed.

The last Dieldrin application to the treated plots was made in August, 1958. A marked increase in Marmara, Eulophonotus and Stem webber attack was evident in August, 1959 while during the past quarter the incidence of these minor pests has fallen, more or less to pre-treatment levels.

BUNSO AREA

Ant population figures are remaining steady on all plots

although there is evidence of a rise in activity following the increase which is occurring in the P. njalensis population. A most unexpected feature is the high incidence of Marmara damage on all treated plots even where a trunk banding treatment of 10% Dieldrin Urea/Formaldehyde Resin was applied. The population of Eulophonotus myrmeleon has also increased on all treated plots whereas there is no damage recorded for untreated plots.

ANT/MEALYBUG POPULATION STUDIES

A survey of the various species of mealybugs (Pseudococcidae) and the Crematogasterine, Pheidoline and Componotine ants on young cocoa is being carried out at four centres at W.A.C.R.I.

Before planting, the secondary bush was felled, and left in situ, at two of the centres, but removed after felling at the other two. At three of the centres insecticides have been used regularly to control capsids and Earias larvae, but none has been applied at the fourth one.

The survey data reveal that the ant/mealybug populations are markedly different at the four centres, but it is not yet possible to give any explanation for these differences.

CHEMISTRY DIVISION

SOIL FERTILITY

FIELD EXPERIMENTS

The September applications of nitrogen were completed on all trials during the quarter.

A very heavy mid-crop has occurred on most experiments. The Amelonado Shade and Manurial trial is showing similar differences in yield as in previous seasons, the responses to shade removal and fertilizer applications having continued.

During August and September, severe leaf symptoms have appeared on a plot of young, unshaded and heavily bearing Amazon cocoa (Plot A6). The symptoms consist of chlorosis followed by necrosis of the leaves. The chlorosis begins at the terminal end of the leaf, spreading along the sides. Often it will also appear as interveinal necrotic patches.

The symptoms are associated with the fertilizer treatment occurring on the plots, and the original (now non-existent) cover crop treatments. The wide-spread symptoms are much less frequent and severe where Elephant grass mulch has been applied or

KMg fertilizer dressings have taken place. Indications of potassium deficiency being involved are evident. Work has commenced to confirm this, and attempt to discover the mechanism whereby potassium deficiency produces these symptoms.

POT EXPERIMENTS

The experiment to study the effect of ammonium sulphate applications on soil pH and manganese uptake was continued.

IRRIGATION

The cocoa in the Pilot irrigation trial (H4(a)) began flowering this year, and fortnightly records of flower production and pod development have been taken.

Large differences in the number of flowers produced by the trees under different water regimes are apparent. The recorded differences to the end of September are shown below. It is not yet known to what extent these differences are due directly to the water treatments, or to differences in the size of the trees as affected by the water regimes. Work is in progress to determine this.

Treatment A = not allowing top 6" of the soil to dry out beyond 75% of total available water = 13,228 flowers.

Treatment B = as above but 50% soil moisture being the critical level = 9,076 flowers.

Treatment C = natural rainfall only = 3,029 flowers.

During the quarter, Nylon resistance units have been installed at 3", 6", 12" and 18" below the surface at several positions in each plot. It is hoped to be able to discontinue gravimetric moisture determinations after a calibration period, and to obtain information about the movement of water in the profile throughout the cocoa root zone.

LABORATORY STUDIES

PLANT SOIL AND ANALYSIS

Routine chemical analysis of plant material continued. A wide survey of trace element contents of Ghana soils was also commenced, using spectrographic techniques.

Studies have also been commenced to find out the effect of certain fertilizer treatments on soils and the uptake by field cocoa

COCOA PREPARATION AND QUALITY

Studies of large-scale fermentation continue. The instal-

lation of the mechanical drying equipment is nearly complete

Laboratory work on small scale fermentation has included comparison of the behavious of approved Amazon cocoa with that of Amelonado.

PLANTATION MANAGEMENT DIVISION

Pods harvested

The tables below show the number of pods harvested during the quarter.

SQUARE MILE

Period	Young Cocoa		Mature cocoa	Total pods Amelonado
	Amelonado	Amazon		
July	22,373	84	40,738	63,195
August	29,260	48	78,046	107,354
September	32,480	60	78,560	111,100
Total	84,113	192	197,344	281,649

OLD STATION

July	6,992	2,104	41,894	50,990
August	16,614	6,235	51,355	74,204
September	15,322	3,811	71,898	91,031
Total	38,928	12,150	165,147	216,225

I B A D A N S T A T I O N

PATHOLOGY SECTION

VECTORS OF NIGERIAN COCOA VIRUSES

Only Adansonia digitata L. became infected with preparations

of Cacao Necrosis Virus (CNV) in experiments using a variety of test plants. This suggested that CNV is not one of the nematode transmitted viruses which are known to have wide host ranges and no further attempts to transmit CNV by nematodes have been made. The susceptibility of A. digitata suggested also a closer relationship of CNV to swollen shoot and mottle leaf viruses and attempts to transmit CNV by mealybugs using A. digitata seedlings as test plants have been made. Ferrisiana virgata (CK11) and Pseudococcus njalensis Laing have transmitted CNV from mechanically infected A. digitata and graft-infected cocoa seedlings to A. digitata. The transmission rate has so far been variable and generally low.

EXTRACTION AND PURIFICATION OF NIGERIAN COCOA VIRUSES

Concentrated extracts from virus infected cocoa and A. digitata seedlings have frequently been highly infective, but attempts to obtain partly purified preparations have so far failed.

THE EFFECT OF ENVIRONMENT ON YOUNG INFECTED COCOA IN THE FIELD AT ALAKIA.

This experiment, described in Quarterly Report No. 54, was planted in June 1959, and consists of five replications of four ground-cover treatments; a factorial layout of fertilizer application and virus inoculation is superimposed on the main plots. Two replications were planted with open-pollinated F_3 Amazon seedlings, and three with an Amelonado hybrid. Fertilizer was applied in September and March, and virus inoculations were carried out in March 1960. The mulch and bare soil treatments have continued to make good growth. It appears that the Amazon and Amelonado replicates have responded differently, particularly to fertilisers, and the data are being re-evaluated in the light of this effect.

THE INTERACTION OF SWOLLEN SHOOT VIRUS AND CAPSID DAMAGE ON THE GROWTH OF YOUNG TREES

Two trials were laid down in 1958 and 1959 to investigate this interaction. One, at Agodi, involves a factorial layout of virus infection, and canopy damage. The latter treatment is designed to simulate capsid feeding damage. Virus has had a severe effect on flushing, and canopy category records of the four treatments indicate that the combined effect of canopy damage and virus infection is greater than the effect of either factor alone. In the second trial, at Ajia, three groups of trees were inoculated with virus at different times and a fourth group was retained as a healthy control. Calonectria inoculations were made into each group of trees at the different phases of virus infection in each treatment. There were differences between the virus treatments in their effect on flushing, and these are related to season.

TOLERANCE TO SWOLLEN SHOOT DISEASE.

Insectary and field experiments are continuing. A series of hand pollinations was begun in May 1960 to investigate the inheritance of reaction to virus infection, and the inheritance of the tolerance of Nanay and Nanay-Iquitos types, in particular C77. Nanay-Iquitos and Trinitario types with varying levels of tolerance are being crossed, with the aim of producing vigorous tolerant hybrids, and of assessing the potentialities of this approach. This programme is severely limited by the availability in Nigeria of the parent Amazon types, though the plant breeder at Tafo is assisting by carrying out certain pollinations which cannot be carried out at Ibadan.

BLACK POD CONTROL

Laboratory Studies

The techniques described previously (Rep. West African Cocoa Research Institute 1958-59, Quarterly Report 1960) for the laboratory assessment of fungicides have been used for the screening of a further series of fungicides.

Within the copper group of fungicides the general relationship that cuprous oxide formulations are superior to copper oxychlorides has been maintained, though two copper oxychloride formulations with high proportions of very small particles have proved somewhat superior to other copper oxychlorides. Other materials which have shown some promise are an organo-tin formulation and a captan formulation. Further work will be necessary to determine optimum dosages for these materials.

The laboratory rain tower mentioned in April-June 1960 Quarterly Report has been brought into use to assess a range of fungicides for their rainfastness. The temperature of the rainfall can now be standardised and rain droplets of diameter 0.76 cm. fall through 167 cm. onto batches of 4 pods, from 145 nozzles fixed in the bottom of a perspex tank at 1" intervals on a square grid. A head of 22.5 cm. filtered tap water is maintained in the tank and this causes a mean rainfall of about 20"/hr.

Most of the formulations studied were found to be resistant to leaching with about half of the initial deposit being removed by 32" rainfall. For only one or two formulations was there evidence that the poor field performance could be explained by lack of rainfastness.

Studies of the effect of drying time between spraying and rain leaching were carried out on one formulation and it was shown

that retention was greatly reduced if rainfall occurred before drying off of the spray deposit.

Field Studies

The two field trials mentioned in the April-June 1960 Quarterly report have been continued, and will be completed during the next quarter. Black pod incidence has been high and preliminary indications are that the range of fungicides studied have shown effectiveness in the order predicted from laboratory evaluations.

ENTOMOLOGY SECTION

SHOT HOLE BORER STUDIES

A technique has been developed whereby mature adults of Xyleborus morstatti Hag. may be removed from galleries in coffee stems collected in the field and induced to attack stems of seedling coffee in the laboratory. Adult beetles are placed in small cages of polythene tubing, fitted at one end with a wire gauze cover and at the other contoured to fit the stem against which they are retained with plasticene. Adults have already been reared by this method.

A slight modification of this type of cage allows its use on cocoa seedlings. When X. morstatti attacks cocoa there is usually a flow of sap which starts as soon as a gallery reaches the sap wood. This is sufficient to fill the cages and drown test insects. If the cages are lined with filter paper and have a wick fitted to contact the stem below the gallery entrance the sap is drained away and attack proceeds unhindered, as in the field.

The use of such cages enables the combined effects of borer attack and water relations to be studied under controlled conditions. Information obtained in this way should assist in the interpretation of the field trial (mentioned in Quarterly Report No. 58) designed to study the effects of cultural conditions in relation to borer attack. Results will be reported as soon as sufficient data has been gathered.

In an area of seedling cocoa at Araromi, in which it is proposed to investigate the effects of several insecticides in borer control, attack was noted when the first pre-treatment count was made between the 8th and 14th of September. Out of 1440 test seedlings 1.18 per cent were freshly attacked. This indicates that infestation may begin well before the end of the wet season and suggests that spraying should commence before dry conditions, when it has normally been assumed attack begins, appear.

Studies on the mode of transmission of Ambrosia fungus, from the parent gallery to a new gallery, have begun. A culture of the fungus, obtained from coffee, has been sent to the Commonwealth Institute of Mycology for identification.

Work on flight activity and range of movement in relation to an infestation focus on coffee have also commenced.

MINOR PESTS OF COCOA

A Tragocephala Studies previously unknown Ichneumonid parasite has been reared from pupal cells of Tragocephala nobilis F. var. gorilla Thoms. collected at Egbeda, Ibadan Province.

Scale Insects

The species of Asterolecanium mentioned in the previous Quarterly Report has been identified by the Commonwealth Institute of Entomology as being close to the cosmopolitan A. pustulans Ckll. This is the first record from Africa of this genus on cocoa.

SEKA.